(12) **United States Patent**

Nath et al.

(10) **Patent No.:** **US 9,462,060 B2**

(45) **Date of Patent:** **Oct. 4, 2016**

(54) **SYSTEM AND METHOD FOR SENDING NOTIFICATION MESSAGE TO A MOBILE STATION USING SESSION INITIATION PROTOCOL (SIP)**

(75) Inventors: **Badri Nath**, Edison, NJ (US); **Rakesh Kushwaha**, Marlboro, NJ (US); **Aman Bhasin**, Old Bridge, NJ (US)

(73) Assignee: **Alcatel Lucent**, Boulogne-Billancourt (FR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 410 days.

(21) Appl. No.: **11/786,000**

(22) Filed: **Apr. 23, 2007**

(65) **Prior Publication Data**

US 2008/0261631 A1 Oct. 23, 2008

(51) **Int. Cl.**
H04L 29/08	(2006.01)
H04L 29/06	(2006.01)

(52) **U.S. Cl.**
CPC *H04L 67/125* (2013.01); *H04L 65/1006* (2013.01)

(58) **Field of Classification Search**
CPC H04L 67/125; H04L 65/1006
USPC 455/466, 435.1; 709/217, 218, 219, 709/220, 221, 222
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,978,367	A	*	11/1999	Kinnunen	.... H04B 7/2681
					370/337
6,128,644	A	*	10/2000	Nozaki	.... G06F 9/505
					709/201

6,144,849	A	11/2000	Nodoushani
6,381,454	B1	4/2002	Tiedemann
6,438,114	B1	8/2002	Womack et al.
6,466,779	B1	10/2002	Moles

(Continued)

FOREIGN PATENT DOCUMENTS

EP	1662829 A1	5/2006
JP	11-308273	5/1999

(Continued)

OTHER PUBLICATIONS

Notification of Transmittal of International Search Report and the Written Opinion of the International Searching Authority dated Jun. 27, 2008 for PCT Application No. PCT/US200861305.

(Continued)

Primary Examiner — Olumide T Ajibade Akonai

Assistant Examiner — Martin Chang

(74) *Attorney, Agent, or Firm* — Brosmer, Kolefas & Associates, LLC

(57) **ABSTRACT**

The present invention is a method and system for sending SIP notification messages to a wireless device, for example a wireless telephone, that can accept SIP control messages. A method is described for establishing a data session between a wireless device and a management server over a wireless network, the wireless device operable to receive and parse SIP messages, the wireless network operable to transmit messages between the wireless device and the management server. The method includes retrieving an address for the wireless device on the management server, sending a SIP invite message from the management server to the wireless device, receiving the SIP invite message on the wireless device, parsing the SIP invite message on the wireless device, and establishing the data session between the wireless device and the management server.

23 Claims, 6 Drawing Sheets
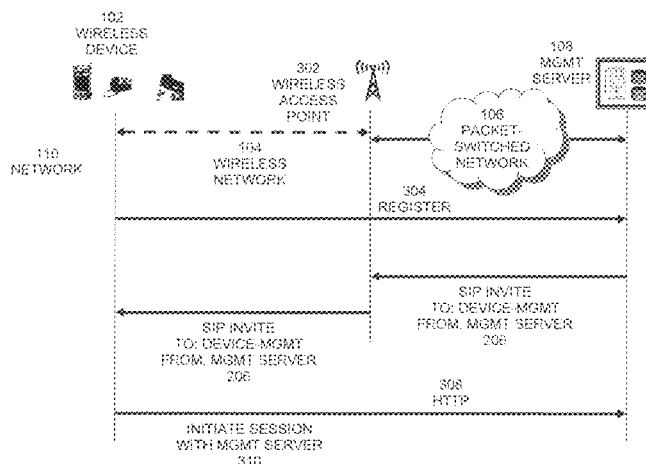
(56)   **References Cited**

U.S. PATENT DOCUMENTS

6,529,729	B1	3/2003	Nodoushani
6,549,770	B1	4/2003	Marran
6,577,614	B1	6/2003	Cook
6,622,017	B1	9/2003	Hoffman
6,625,451	B1	9/2003	La Medica, Jr.
6,725,056	B1	4/2004	Moles
6,732,105	B1*	5/2004	Watson, Jr. G06F 21/31
6,813,264	B2	11/2004	Vassilovski
6,845,092	B2	1/2005	Vassilovski et al.
6,980,556	B2	12/2005	Vimpari
7,020,440	B2	3/2006	Watanabe et al.
7,085,253	B2	8/2006	Yang
7,305,090	B1	12/2007	Hayes
2002/0037723	A1*	3/2002	Roach H04L 67/30 455/435.1
2002/0073203	A1*	6/2002	Gilleland 709/227
2003/0014488	A1*	1/2003	Dalal et al. 709/204
2003/0101246	A1*	5/2003	Lahti 709/221
2003/0153339	A1*	8/2003	Crockett H04M 3/56 455/518
2003/0166398	A1	9/2003	Netanel
2004/0024879	A1*	2/2004	Dingman et al. 709/227
2004/0032843	A1*	2/2004	Schaefer et al. 370/338
2004/0242209	A1	12/2004	Kruis et al.
2005/0055687	A1*	3/2005	Mayer 717/173
2005/0181793	A1	8/2005	Netanel
2005/0254510	A1*	11/2005	Oja et al. 370/431
2006/0023651	A1	2/2006	Tsuchiuchi et al.
2006/0165060	A1*	7/2006	Dua G06Q 20/20 370/352
2006/0174117	A1*	8/2006	Laitinen H04L 9/0844 713/169
2006/0190575	A1	8/2006	Harvey
2007/0136795	A1	6/2007	Youn
2009/0024848	A1	1/2009	Takasugi

FOREIGN PATENT DOCUMENTS

JP	2004518356	6/2004
JP	200642087	2/2006
JP	2006-333034 A	7/2006
JP	2006-333277 A	7/2006
JP	2007-049645 A	2/2007
WO	02058361 A2	7/2002
WO	2005109947 A1	11/2005

OTHER PUBLICATIONS

Notification of Reason for Rejection Japanese Office Action dated Apr. 23, 2012 received in corresponding Application No. 2009-528271.

Delaney, Brian William; "Reduced Energy Consumption and Improved Accuracy for Distributed Speech Recognition in Wireless Environments" Ph.D. Thesis, Georgia Tech Electrical and Computer Engineering Dept. Published Sep. 2004, www.gtel.gatech.edu/bitstreamll23456789.

Official Communication dated Apr. 8, 2008 which accompanies an International Search Report and a Written Opinion of the International Searching Authority, in PCT/US 07119818.

Non-Final Office Action dated Feb. 1, 2010, received in U.S. Appl. No. 11/798,243.

Final Office Action dated Jul. 19, 2010, received in U.S. Appl. No. 11/798,243.

Supplementary European Search Report dated Feb. 7, 2012 received in Application No. 07838093.8-2413/2060106.

Extended European Search Report dated Jan. 19, 2012 received in Application No. 07838093.8-2413/2060106.

JPO, Office Action in JP Patent Application No. 2010-506457, mailed Dec. 17, 2012.
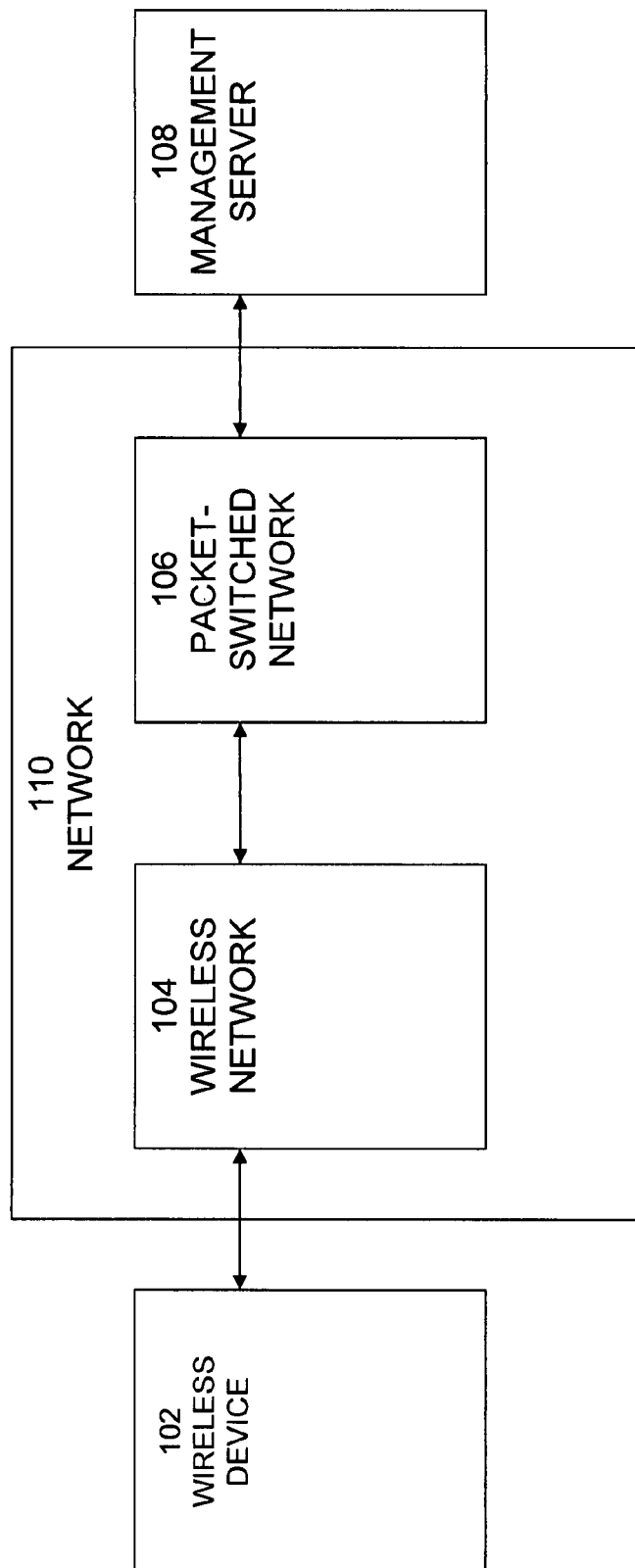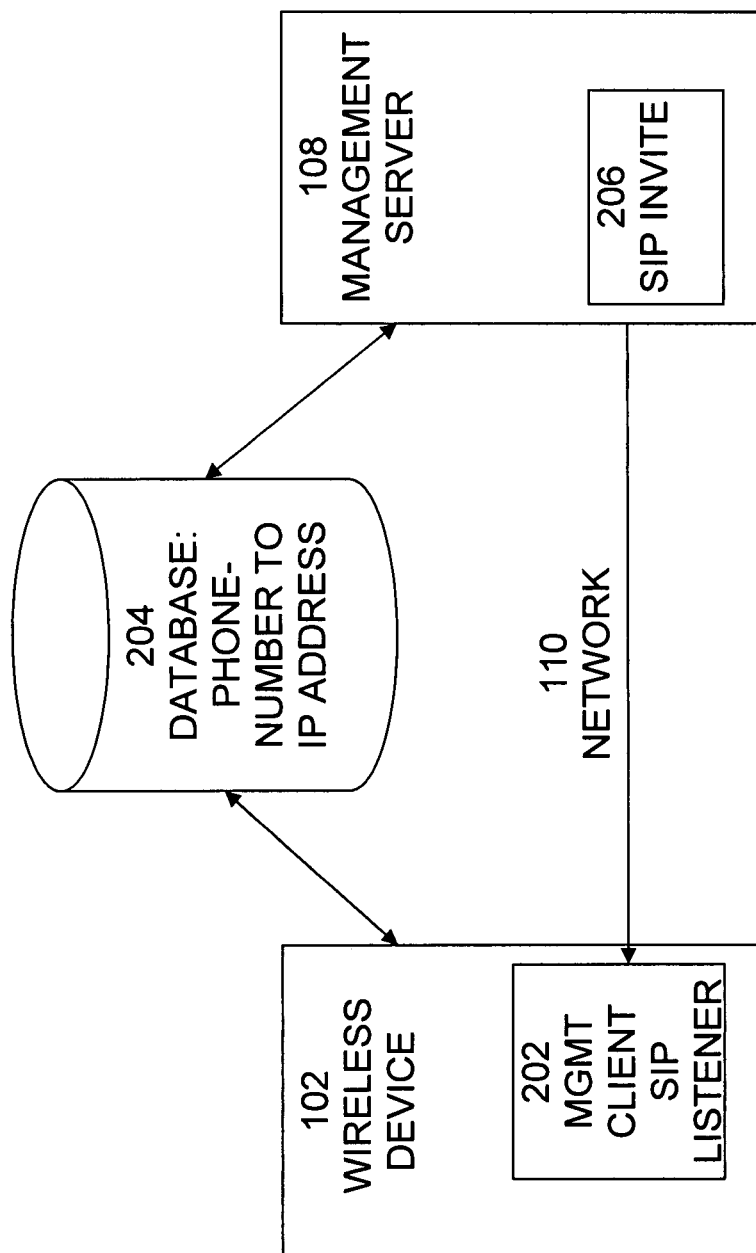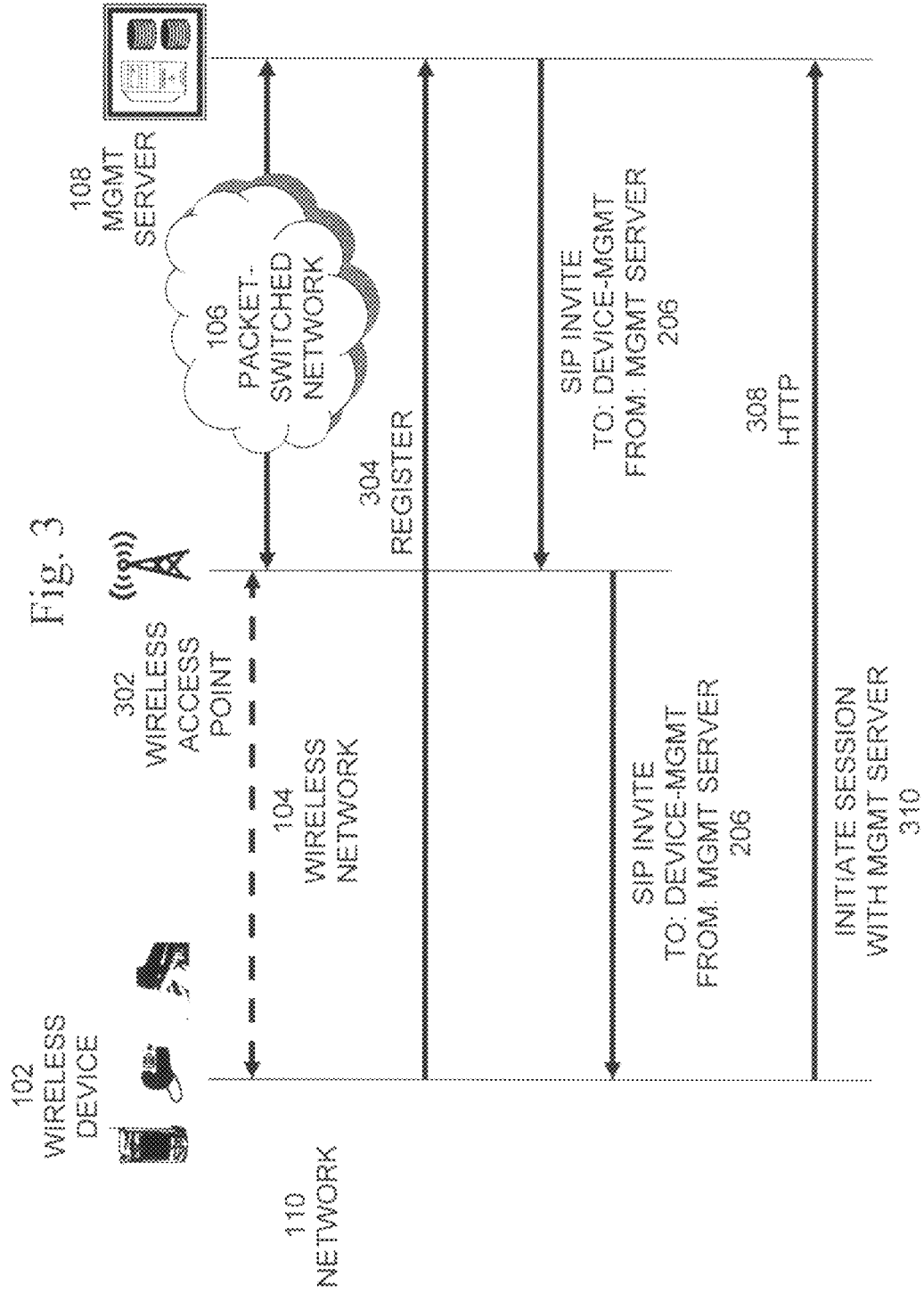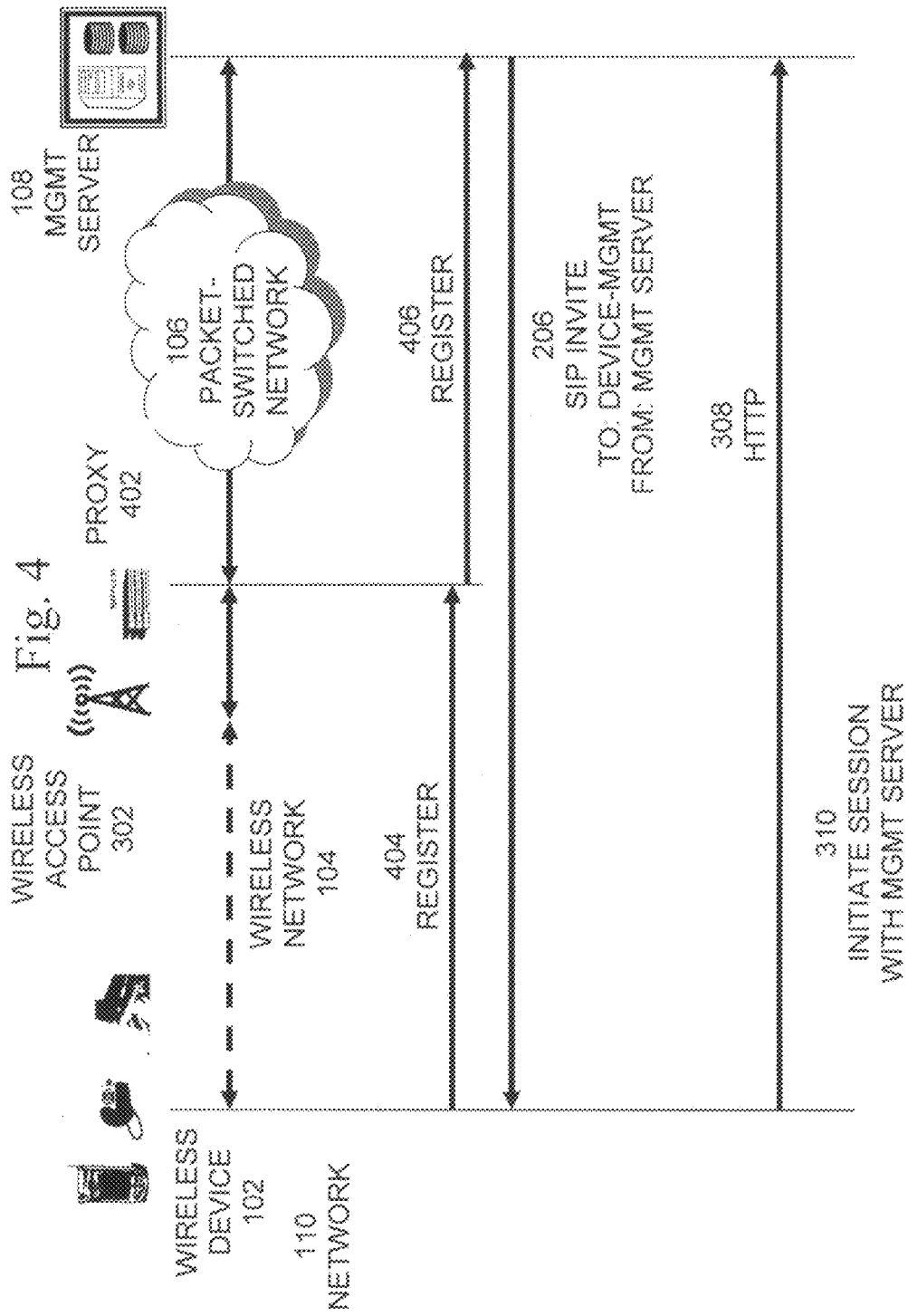
* cited by examiner

Fig. 1

108
MANAGEMENT SERVER

110
NETWORK

106
PACKET-SWITCHED NETWORK

104
WIRELESS NETWORK

102
WIRELESS DEVICE

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

600
USER SYSTEM

| 604 INPUT/ OUTPUT | 602 CPU | 606 NETWORK ADAPTER |

110
NETWORK

608
MEMORY

610
PROCESSING ROUTINES

612
FILE ACCESS ROUTINES

614
APPLICATIONS

616
OPERATING SYSTEM

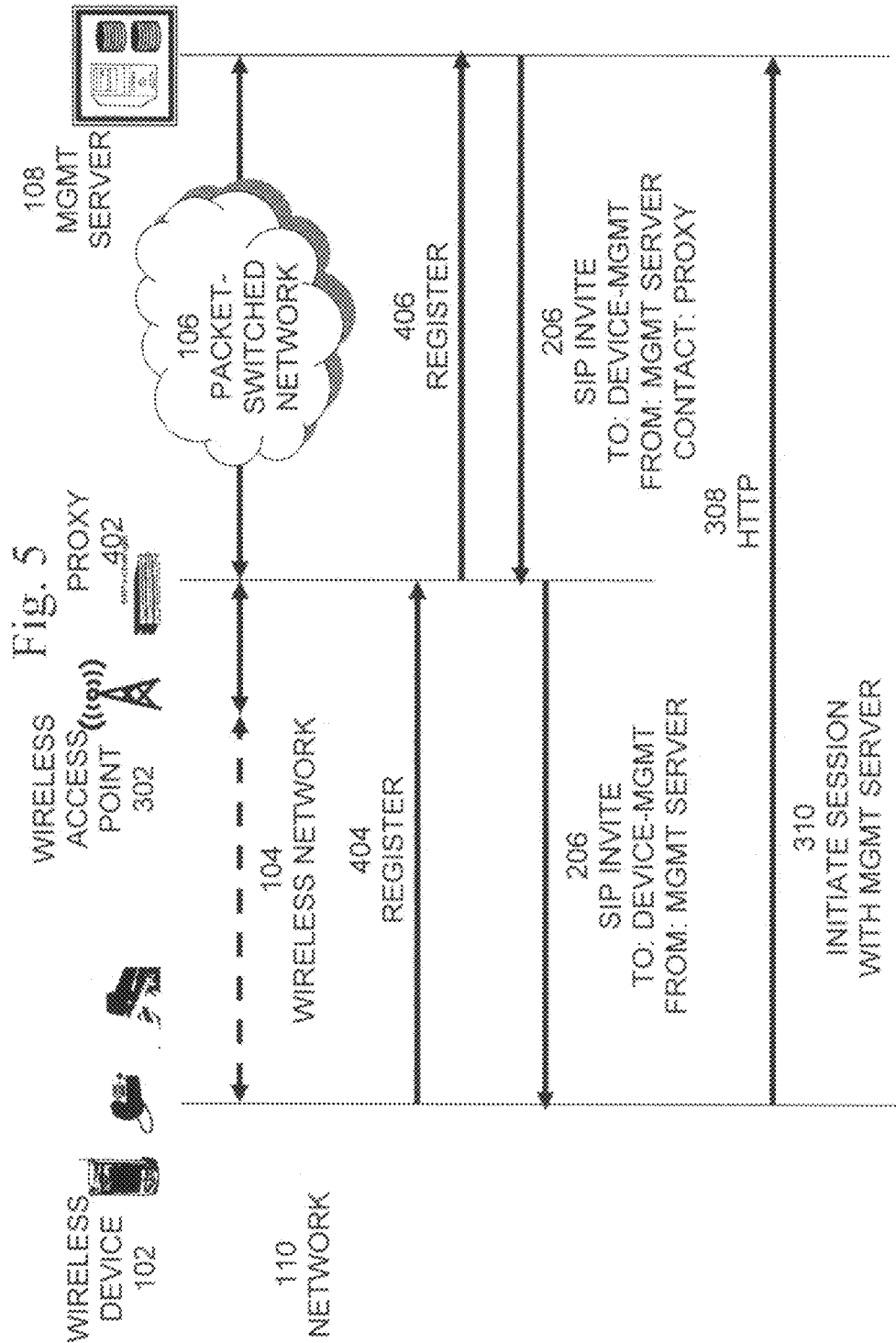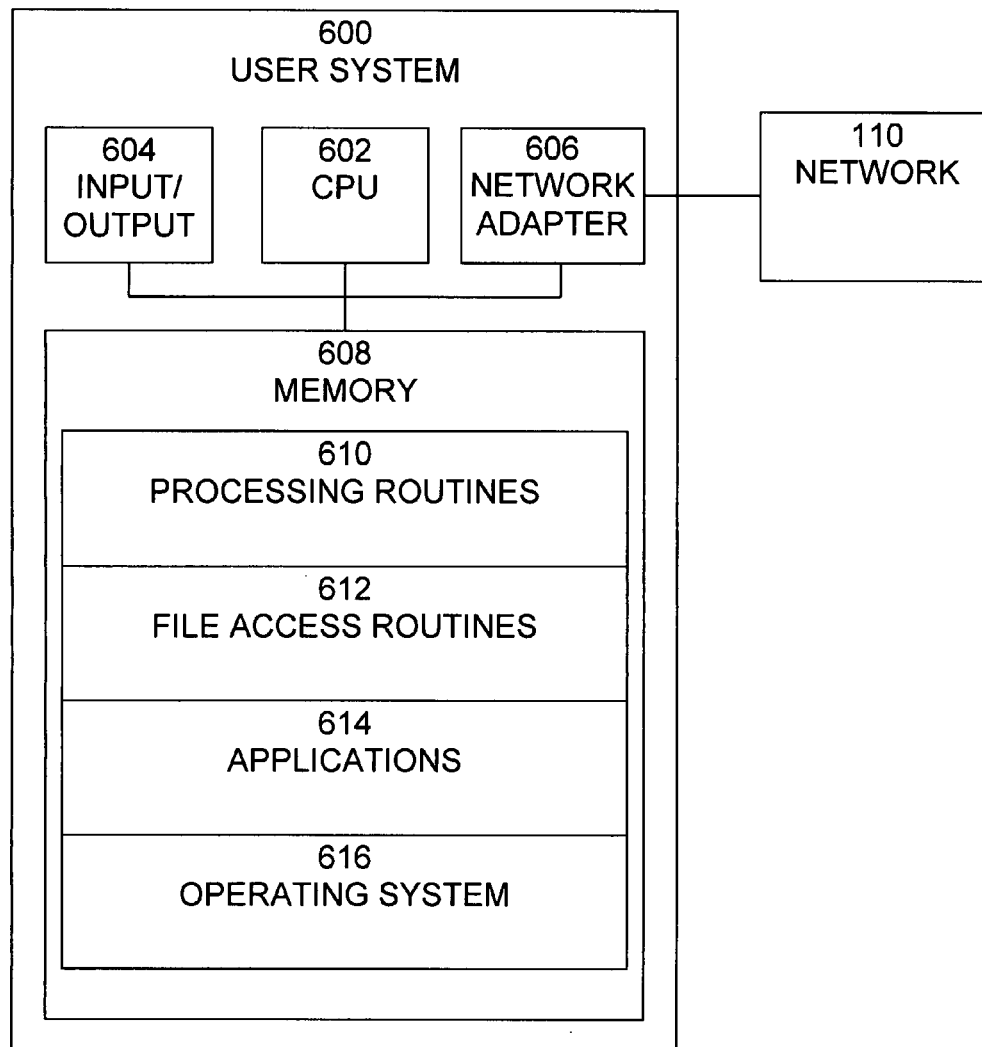## SYSTEM AND METHOD FOR SENDING NOTIFICATION MESSAGE TO A MOBILE STATION USING SESSION INITIATION PROTOCOL (SIP)

FIELD OF THE INVENTION

The present invention relates to a system and method using Session Initiation Protocol (SIP) control messages to send notification messages from a management server to wireless devices so that they can connect back to the management server. The SIP based messages are sent between the management server and the wireless device using a packet-switched network, such as an IP-based network, or between the management server and a proxy device with which the wireless device is registered.

BACKGROUND OF THE INVENTION

Remote wireless device management refers to implementations and proposals for managing wireless devices remotely by sending commands from a management system to the devices. Typically, the device is sent a notification message using SMS (Short Message Service) with the telephone number of the device as the destination. On receipt of the notification the device connects to the management server. Historically, SMS has been the bearer of choice for such notifications because it can be sent to any wireless device when only the telephone number of the device is known. Further, SMS is an always-on interface, in that as long as the device is registered with the wireless network, SMS messages can be delivered to the device. However, with the development of wireless devices which support wireless interfaces other than SMS, including Internet Protocol (IP), there is a need to push notifications using packet-switched networks.

Packet-switched networks, including the internet, may use IP for transporting packets between hosts in a network. Voice as well as data may be sent over a packet-switched network. Voice over IP (VOIP) architecture provides a protocol called session initiation protocol (SIP) that handles signaling for call management functions. Examples of functions provided by SIP include INVITE, ACK, REGISTER, BYE, CANCEL etc. These functions can be interpreted by VOIP network elements to provide call management functions. For example, a SIP INVITE message indicates that a user or service is being invited to participate in a call session. Any network that supports VOIP should be configured to allow SIP messages to be routed to a host or device destination.

Wireless devices are increasingly being deployed that carry voice traffic supported by VOIP and SIP. Some converged devices support two distinct wireless interfaces; one using the traditional mobile wireless communications protocols and networks (for example, CDMA, GPRS, GSM and other conventional wide-area wireless networks and protocols) and another using interfaces that directly support the packet-switched IP protocol, such as IMS (IP multimedia subsystems), Wi-Fi, and WiMax. Wireless devices and networks that support SIP offer several advantages, including lower cost, over traditional wireless radio technologies.

These advantages drive a need to support SIP protocols on wireless devices in order to support functions previously implemented manually or over conventional networks, such as sending different types of notifications to wireless devices. One important function, using SIP messages to notify wireless devices to initiate management sessions with

a server, has the advantage of providing an alternative to SMS. This capability would be useful where sending a message to devices through a packet-switched network is the preferred method of initiating management sessions with devices, for example for converged devices or where SMS is not available due to lack of coverage.

SUMMARY OF THE INVENTION

The present invention is a method and system for sending SIP notification messages to a wireless device, for example a wireless telephone, that can accept SIP control messages. The method and system of the present invention use SIP messages as notifications to host or device end-points in order to initiate remote management sessions with a server.

In one aspect of the present invention, a management server notifies the device client to establish a connection with the server, and provisions, activates, and/or manages the wireless device by programming the device with parameters and software. In order to connect to the management server, the device needs information about how to contact the server. A device that is pre-provisioned with the necessary information to connect to a management server on receipt of a notification message is called a "bootstrapped device". Bootstrap information—such as the address of the management server, the necessary credentials to communicate with the server, etc.—is sufficient for the device to establish a management session. During the resulting management session, the required parameters and software required for management of device on the network are sent to the device.

A SIP invite message is sent by a management server to notify a wireless device to initiate a management session. The management server can send the SIP message over a packet-switched network.

The present invention includes a system comprising a mobile wireless network connected with VOIP-enabled wireless devices. In the VOIP protocol, an SIP invite message can be used to establish a call session as well as establish a data session. In one embodiment of the present invention SIP invite is used to notify a wireless device to initiate a data session with a management server.

In one aspect of the invention, a method is described by which a management server sends notifications to a device using a SIP invite message. The method comprises receiving the telephone number of the device and embedding the credential information in the invite message. The credential information includes the address of the management server and the security credentials necessary to access the management server.

In another aspect of the invention, the management server determines the IP address of the device given the device's telephone number and then sends a notification message embedded in a SIP invite message over the network. In another aspect of the invention, the device informs the management server of its link local address (the device's own IP address derived from its MAC address).

In another aspect of the invention, a wireless device uses SIP messages to register with a proxy device which in turn registers the device with a management server. The registration information sent by the wireless device includes the capability of the wireless device. The management server will send a SIP invite message to the device to initiate a management session.

In another aspect of the invention, a wireless device uses SIP messages to register with a proxy device which in turn registers the device with a management server. The regis-

tration information sent by the wireless device will include a tag classifying the wireless device as direct or indirect. The management server structures the header of a SIP invite notification message based on the tag of the wireless device. If the tag indicates a direct device, the SIP invite message is sent from the management server directly to the wireless device. If the tag indicates an indirect device, the SIP invite message is sent to the proxy device which in turn relays the notification message to the wireless device. When a notification message is sent through the proxy device, the header information needed for the wireless device will be embedded inside the header information for the proxy device. The notification message will be contained in the message portion of the SIP invite message.

Yet another aspect of the invention is directed at a method by which the wireless device or the proxy device informs the management server of any change in the IP addresses of the wireless device due to a move into a new network or reassignment of the IP address.

The present invention teaches a method for establishing a data session between a wireless device and a management server over a wireless network, the wireless device operable to receive and parse SIP messages, the wireless network operable to transmit messages between the wireless device and the management server. The method includes retrieving an address for the wireless device on the management server, sending a SIP invite message from the management server to the wireless device, receiving the SIP invite message on the wireless device, parsing the SIP invite message on the wireless device, and establishing the data session between the wireless device and the management server.

In another aspect of the invention, the SIP invite message contains bootstrap information for the wireless device to connect to the management server.

In another aspect of the invention, the bootstrap information contained in the SIP invite message includes server security credentials and a server address to which to connect to the management server.

In another aspect of the invention, there is an additional step of receiving notification messages sent by the management server as SIP invite messages on a specific port on the wireless device.

In another aspect of the invention, there is an additional step of registering a device identity and network address of the wireless device with the management server.

In another aspect of the invention, there is an additional step of determining the network address of the wireless device from a device identity.

In another aspect of the invention, the step of determining the network address of the wireless device includes sending the device identity from the management server to a database using a SIP message and sending the network address of the device to the management server from the database using a SIP message.

In another aspect of the invention, there is an additional step of re-registering the wireless device with the management server when a network address of the wireless device changes.

A method is described for establishing a data session between a wireless device, a proxy device and a management server over a wireless network, the wireless device and the proxy device operable to receive and parse SIP messages, the wireless network operable to transmit messages between the wireless device and the proxy device and the management server. The method includes registering the wireless device with the proxy device, sending a notification message embedded inside a

SIP invite message from the management server to the proxy device, sending the SIP invite message from the proxy device to the wireless device, receiving the SIP invite message on the wireless device, and parsing the SIP invite message on the wireless device.

In another aspect of the invention, a device identity of the wireless device is encapsulated within the SIP message sent to the proxy device. In another aspect of the invention, the notification message embedded in the SIP invite message contains bootstrap information for the device to connect to the management server. In another aspect of the invention the bootstrap information contained in the SIP invite message includes server credentials and a server address to which to connect to the management server.

In another aspect of the invention, there is an additional step of receiving the notification messages sent as SIP invite messages on a specific SIP port on the wireless device. In another aspect of the invention, there is an additional step of registering a network address of the proxy device with the management server. In another aspect of the invention, there is an additional step of registering a device identity and network address of the wireless device with the proxy device.

In another aspect of the invention, the proxy device registers a network address of the wireless device with the management server.

In another aspect of the invention, a link local address of the wireless device is encapsulated within the SIP message sent to the proxy device. In another aspect of the invention, the proxy device is listening on a special port for notification messages sent as SIP invite messages. In another aspect of the invention, the proxy registers its network address with the management server.

In another aspect of the invention, the wireless device registers its device identity and link local address with the proxy device. In another aspect of the invention, the proxy registers the link local address of the wireless device with the management server.

In another aspect of the invention, there is an additional step of re-registering the proxy device with the management server when a network address of the proxy device changes. In another aspect of the invention, there are additional steps, including detecting a change of a network address of the wireless device, re-registering the wireless device with the proxy device, and sending the re-registration of the wireless device to the management server from the proxy device.

In another aspect of the invention, the proxy device, on a change in a network address of the registered wireless device, re-registers the network address of the wireless device with the management server.

BRIEF DESCRIPTION OF THE DRAWINGS

The details of the present invention, both as to its structure and operation, can best be understood by referring to the accompanying drawings, in which like reference numbers and designations refer to like elements.

FIG. 1 is an exemplary block diagram of a network system in which the present invention may be implemented.

FIG. 2 is an exemplary block diagram of the network system shown in FIG. 1 incorporating the messaging technique of the present invention.

FIG. 3 is an exemplary flow diagram of a process where a wireless device registers with a management server.

FIG. 4 is an exemplary flow diagram of a process where a wireless device registers with a proxy device and a notification message is sent to the wireless device.

FIG. **5** is an exemplary flow diagram of a process where a wireless device registers with a proxy device and a notification message is sent indirectly to the wireless device via the proxy device.

FIG. **6** is a diagram of an exemplary block diagram of a system on which the present invention may be implemented.

DETAILED DESCRIPTION OF THE INVENTION

An exemplary block diagram of a network system in which the present invention may be implemented is shown in FIG. **1**. The system in FIG. **1** is configured to remotely manage one or more wireless devices **102**. A management server **108** is connected to a packet-switched network **106** which in turn is connected to a wireless network **104**. The wireless device **102**, either when notified by the management server **108** or periodically, communicatively connects to the management server **108** to initiate a management session, also called a data session, during which management actions are performed on the device **102**. Management actions performed during a data session or management session may include, but are not limited to, programming the device **102** with parameters and software for provisioning, activating, or updating of the device **102**. Wireless network **104** is connected to a device **102**, for example by a wireless interface. Wireless network **104** may use communication protocols or other wireless link protocols, including but not limited to CDMA, GPRS, UMTS, HSPDA, EVDO, EVDV, WiFi, WiMAX, or Bluetooth.

A mobile wireless device **102** can be any device that supports wireless communication including mobile telephones, laptop computers, personal digital assistants (PDAs), or network-capable-televisions. The device **102** could support a single wireless communication standard or support multiple wireless communication standards. These communication standards are exemplified by wireless networks such as GSM, CDMA, FOMA, next generation technologies found in cellular communication systems, as well as packet-switched IP-based wireless networks exemplified by Bluetooth, **802.11** or WiMax networks. A device **102** supporting multiple standards may communicate on any of the standards either separately or simultaneously. The communication could occur in different mediums, for example, over licensed spectrum or unlicensed spectrum or in another example, over local area networks or wide area networks. The wireless device **102** will support SIP, and may support other protocols, for example SIP-based VOIP.

The wireless device **102** will also support data transmission over packet-switched networks **110**. The device **102** can be connected to network **110** in a variety of ways, for example device **102** may be connected directly to a line-based network **106**, or in another example to a wireless network **104**, or for example simply treat the networks as transparent **110** (any combination of a wireless or line-based network, including solely one or the other). Network **110** may include one or more networks, for example may include both public networks and private networks, and may utilize any packet-based networking protocol such as Transmission Control Protocol/Internet Protocol (TCP/IP).

As shown on FIG. **2**, a management client **202** on the wireless device **102** is capable of handling messages received over a network **110**. The network **110** supports sending of messages using SMS (short messaging service) or using SIP. The management client **202** is capable of receiving and parsing SIP messages. The management client **202** for example may be software programmed on the

memory of device **102**, or as another example, may be programmed on a chip integrated into the hardware of a device **102**, or in yet another example may be added as a portion of hardware peripheral and connected to device **102**. Management client **202** may have a number of functions, for example, listening for, sending, or receiving SIP messages over the network **110**. Management client **202** may communicatively connect with any system or device on network **110**, for example including database **204** or management server **108**. Any firewalls or gateways in the network **110** will be configured to allow SIP messages to pass through.

The management server **108** is connected to the packet-switched network **110** as shown in FIG. **2**. To send a message to any host on the network **110**, such as the wireless device **102**, the management server **108** may obtain the network address, such as the IP address, of the host. The management server **108** addresses messages to a device using the telephone number or other unique identifier of the device **102**.

The device **102** may be registered with the management server **108**, or may be registered with a database **204**. The registration may associate the telephone or MSISDN number of the device **102** with the network address of the device **102**, or may associate some other unique identifier of the device **102** with the network address of the device. If the network address or IP address or SIP caller-id or SIP address of the device **102** is explicitly associated with the device's **102** telephone number or unique identifier at the management server **108** or the management server **108** contacts a database **204** (e.g., enum database, SIP server), the management server will obtain the network address or IP address or SIP caller-id or SIP address of the device **102** using the telephone number or other unique identifier of the device **102**.

The unique identifier, which may be referred to as the device identity, can be a unique immutable string that is associated with the device **102** hardware. This may be assigned to a device **102** by the manufacturer and as such contains information about the device **102**. Examples of such a unique identifier or device identity include device serial number, Electronic Serial Number (ESN), Mobile Equipment Identifier (MEID), (International Mobile Equipment Identity) IMEI, or Stock Keeping Unit (SKU). This device identity generally is associated with a hardware component of the device **102** and uniquely identifies the device **102**.

To initiate a communication with a wireless device **102**, the management server **108** notifies the device **102** of an incoming communication by sending a SIP invite message **206** with a message header in which the destination address is the network address or IP address or SIP caller-id or SIP address of the wireless device **102** obtained by the management server as described above. The management server **108** may address the header of the invite message **206** with information additional to the network address, for example to a particular port of the wireless device **102**, or for example to a particular port that is assigned to or listened to by management client **202** on device **102**. The message header also contains information about the management server **108** such as the server's **108** URL or network address and may also contain the necessary security credentials to initiate a data session between the device **102** and the management server **108**. All the data that is embedded in the SIP invite message that is received by the management client **202** on the device **102** is termed the notification message.

In one aspect of the invention, a wireless device **102** active on the network **110** (network **110** is described more fully with reference to FIG. **1**) can announce its presence on

the network **110** to the management server by registering its network address directly with the management server **108** as shown in FIG. **3**. In the example demonstrated in FIG. **3**, the wireless network **104** consists of one or more wireless access points **302** acting as a gateway between the fixed network **106** and the wireless devices **102**. The device **102** can use any of the available transport mechanisms exemplified by protocols such as SMS, TCP/IP, UDP/IP, SIP REGISTER, https, http to register **304** with the management server **108**. The device **102** may have the address and credentials for the management server **108** because it has previously registered with the management server **108**, or it may have "bootstrap information".

In order to connect to the management server **108**, the device **102** needs information about how to contact the management server **108**. A device **102** that is provisioned with the necessary information to connect to a management server **108** is called a "bootstrapped device". Bootstrap information—such as the address of the management server **108**, the necessary credentials to communicate with the server **108**, etc.—is sufficient for the device **102** to register or to establish a management session. This information may, for example, be pre-loaded onto the device **102**, or alternatively the information may be sent to the device **102** by the management server **108** in the header of an SIP invite message **206** such as a notification message, or in another alternative the bootstrap information may be sent separately within an SIP message sent for the purpose of programming the device **102** with the necessary bootstrap information for the management server **108**, or in another alternative the information may be sent in the header of an SIP message sent to device **102** for any other purpose.

To initiate a management session with the wireless device **102**, according to the example in FIG. **3** the management server **108** embeds a notification message in the SIP invite message **206** and sends it to the wireless device **102**. On receipt and parsing of the SIP invite message the management client **202** on device **102** initiates a data session **310** with the management server **108**.

The management session **310** with the server is typically carried over a standard protocol such as http **308**. However, the session can be carried over any suitable transport available and practical for the device, for example, FTP. Further, a management session **310** could involve multiple interactions between the device and the server.

In another embodiment of the invention, if the wireless device **102** is not be able to directly register with the management sever **108**, the device **102** can register **404** with a local proxy device **402** as shown in FIG. **4**. The proxy device **402** is connected to the network **110** and supports any of the wireless interfaces necessary to communicate with the wireless device **102**. Examples of such proxy devices **402** include but are not limited to set top boxes, cable modem routers, DSL routers, or a customer premises equipment (CPE) device. The proxy device **402** in turn registers **406** the wireless device **102** with the management server **108**.

The registered device **102** is capable of receiving SIP messages, for example directly from the management server **108** or alternatively is capable of receiving SIP messages only from the proxy device **402**. The registration information sent by the wireless device **102** or by the proxy device **402** in steps **304** or **404** may indicate whether the device **102** is capable of receiving messages directly from the management server, for example the registration information may include a tag classifying the wireless device as direct or indirect. The management server**108** may structure the header of a SIP invite notification message based on the tag

sent by the wireless device **102** or proxy **402**. For example, if the tag indicates a direct device, the SIP invite message is sent from the management server **108** directly to the wireless device **102** as shown in FIG. **4**. Alternatively, if the address of the wireless device **102** contained in the registration message is a publicly routable address, then the management server **108** may directly send the SIP invite message **206** to the wireless device **102** as shown in FIG. **4**.

FIG. **4** shows an example of the mechanism by which the proxy device **402** relays a registration message to the management server **108**. The wireless device **102** relays a registration message in step **404** to the proxy device **402** via wireless network **104**. The registration message contains the address of the device **102**. The proxy device **402** relays the registration information to management server **108** via network **106** in step **406**. As shown in FIG. **4**, if the address of the wireless device **102** contained in the registration message is a publicly routable address, then the management server **108** directly sends the SIP invite message **206** to the wireless device **102**. Wireless device **102** initiates a management session with management server **108** in step **308**, for example, using HTTP protocol.

However, as shown, for example, in FIG. **5**, if the address of the wireless device **102** is a private address then the SIP invite message **206** is sent to the proxy device **402** with the device identifier or private address of the wireless device **102** contained in the invite message in step **206**, and the proxy device **402** in turn relays the SIP invite message **206** to the wireless device **102** at the private address of the wireless device **102**. For example, the management server **108** sends a notification message **206** to the wireless device **102** by embedding the private address of the wireless device **102** within the SIP message sent to the proxy device **402**. On receipt of the SIP invite message **206**, the proxy device **402** strips the outer header and relays the SIP message **206** to the wireless device **102**. The wireless device **102** then initiates a management session **310** with the management server **108** via network **110**.

In another embodiment of this invention, the wireless device **102** or the proxy device **402** can reregister with the management server **108** whenever the network address of the wireless device **102** changes. The network address assigned to a device **102** can change for various reasons, for example when the device **102** moves to a different network **104**, or attaches to a different proxy device **402**, or the lease on the assigned network address expires. The management server **108** needs to know the current network address of the device **102** to which the notification is sent. When the device **102** is reregistered with the management server **108**, the destination address of any SIP invite message **206** is updated. The re-registration may involve, for example, any of the steps as explained in the method for registration above, or alternatively, may involve greater or fewer steps.

A block diagram of an exemplary user system **600**, in which the management server **108** of the present invention may be implemented, is shown in FIG. **6**. User system **600** is typically a programmed general-purpose computer system, such as a personal computer, workstation, server system, and minicomputer or mainframe computer. User system **600** includes processor (CPU) **602**, input/output circuitry **604**, network adapter **606**, and memory **608**. CPU **602** executes program instructions in order to carry out the functions of the present invention. Typically, CPU **602** is a microprocessor, such as an INTEL PENTIUM® processor, but may also be a minicomputer or mainframe computer processor. Although in the example shown in FIG. **6**, user system **600** is a single processor computer system, the

present invention contemplates implementation on a system or systems that provide multi-processor, multi-tasking, multi-process, multi-thread computing, distributed computing, and/or networked computing, as well as implementation on systems that provide only single processor, single thread computing. Likewise, the present invention also contemplates embodiments that utilize a distributed implementation, in which user system **600** is implemented on a plurality of networked computer systems, which may be single-processor computer systems, multi-processor computer systems, or a mix thereof.

Input/output circuitry **604** provides the capability to input data to, or output data from, user system **600**. For example, input/output circuitry may include input devices, such as keyboards, mice, touchpads, trackballs, scanners, etc., output devices, such as video adapters, monitors, printers, etc., and input/output devices, such as, modems, etc. Network adapter **606** interfaces user system **600** with Internet/intranet **610**. Internet/intranet **610** may include one or more standard local area network (LAN) or wide area network (WAN), such as Ethernet, Token Ring, the Internet, or a private or proprietary LAN/WAN.

Memory **608** stores program instructions that are executed by, and data that are used and processed by, CPU **602** to perform the functions of user system **600**. Memory **608** typically includes electronic memory devices, such as random-access memory (RAM), which are capable of high-speed read and write operations providing direct access by the CPU **602**. Additional memory devices included in user system **600** may include read-only memory (ROM), programmable read-only memory (PROM), electrically erasable programmable read-only memory (EEPROM), flash memory, electro-mechanical memory, magnetic disk drives, hard disk drives, floppy disk drives, tape drives, optical disk drives, etc.

Memory **608** includes processing routines **610**, file access routines **612**, applications **614**, and operating system **616**. File access routines **614** include software that provides access to files stored on local file storage and remote storage. Applications **614** include software used to perform other functions on user system **600**. Operating system **616** provides overall system functionality.

It is important to note that while the present invention has been described in the context of a fully functioning data processing system, those of ordinary skill in the art will appreciate that the processes of the present invention are capable of being distributed in the form of a computer readable medium of instructions and a variety of forms and that the present invention applies equally regardless of the particular type of signal bearing media actually used to carry out the distribution. Examples of computer readable media include recordable-type media such as floppy disc, a hard disk drive, RAM, and CD-ROM's, as well as transmission-type media, such as digital and analog communications links.

Although specific embodiments of the present invention have been described, it will be understood by those of skill in the art that there are other embodiments that are equivalent to the described embodiments. Accordingly, it is to be understood that the invention is not to be limited by the specific illustrated embodiments, but only by the scope of the appended claims.

What is claimed is:

1. A method for establishing a device management session between a wireless device and a device management server over a wireless network, the wireless device and a proxy device operable to receive and parse Session Initiation

Protocol messages, the wireless network operable to transmit messages between the wireless device and the proxy device and the proxy device and the device management server, the method comprising:

registering the wireless device with the proxy device, where in response thereto, the proxy device sends a registration message to the device management server, the registration message including a network address of the wireless device, wherein a device identity and the network address of the wireless device are registered with at least one of the proxy device and the device management server, the device identity being a unique immutable identity associated with the wireless device;

generating a notification message embedded inside a Session Initiation Protocol invite message including the network address of the wireless device, the Session Initiation Protocol invite message providing an indication to establish the device management session between the device management server and the wireless device;

sending the Session Initiation Protocol invite message from the device management server to the proxy device;

sending the Session Initiation Protocol invite message from the proxy device to the wireless device at the network address of the wireless device;

receiving the Session Initiation Protocol invite message on the wireless device; and

parsing the Session Initiation Protocol invite message on the wireless device.

2. The method of claim **1**, where the device identity of the wireless device is encapsulated within the Session Initiation Protocol invite message sent to the proxy device.

3. The method of claim **1**, where the notification message embedded in the Session Initiation Protocol invite message contains bootstrap information for the device to connect to the device management server.

4. The method of claim **3**, where the bootstrap information contained in the Session Initiation Protocol invite message includes server credentials and a server address to which to connect to the device management server.

5. The method of claim **1**, wherein the Session Initiation Protocol invite message is received on a specific Session Initiation Protocol port on the wireless device.

6. The method of claim **1**, further comprising registering a network address of the proxy device with the device management server.

7. The method of claim **1**, where the proxy device registers the network address of the wireless device with the device management server.

8. The method of claim **1**, where a link local address of the wireless device is encapsulated within the Session Initiation Protocol invite message sent to the proxy device.

9. The method of claim **1**, where the proxy device is listening on a special port for notification messages sent as Session Initiation Protocol invite messages.

10. The method of claim **1**, where the proxy device registers its network address with the device management server.

11. The method of claim **1**, where the wireless device registers its device identity and link local address with the proxy device.

12. The method of claim **1**, where the proxy device registers a link local address of the wireless device with the device management server.

13. The method of claim **1**, further comprising re-registering the proxy device with the device management server if a network address of the proxy device changes.

14. The method of claim **1**, further comprising:
detecting a change of the network address of the wireless device;
re-registering the wireless device with the proxy device; and
sending the re-registration of the wireless device to the device management server from the proxy device.

15. The method of claim **1**, where the proxy device on a change in the network address of the registered wireless device, re-registers the network address of the wireless device with the device management server.

16. The method of claim **1**, further comprising establishing the device management session between the wireless device and the device management server.

17. The method of claim **1**, further comprising determining the network address of the wireless device from a device identity.

18. The method of claim **17**, wherein determining the network address of the wireless device comprises:
sending the device identity to a database using a Session Initiation Protocol message; and
receiving the network address of the device from the database using a Session Initiation Protocol message.

19. The method of claim **1**, further comprising re-registering the wireless device with the device management server if the network address of the wireless device changes.

20. The method of claim **1**, wherein registering the wireless device includes indicating that the wireless device is an indirect device.

21. A method for establishing a device management session between a wireless device and a device management server over a wireless network, the wireless device and a proxy device operable to receive and parse Session Initiation

Protocol messages, the wireless network operable to transmit messages between the wireless device and the proxy device and the proxy device and the device management server, the method comprising:
registering the wireless device with the proxy device, where in response thereto, the proxy device sends a registration message to the device management server, the registration message including a network address and a device identity of the wireless device, wherein a device identity and the network address of the wireless device are registered with at least one of the proxy device and the device management server, the device identity being a unique immutable identity associated with the wireless device;
generating a notification message embedded inside a Session Initiation Protocol invite message including the network address of the wireless device, the Session Initiation Protocol invite message providing an indication to establish the device management session between the device management server and the wireless device;
sending the Session Initiation Protocol invite message from the device management server to the wireless device at the network address of the wireless device;
receiving the Session Initiation Protocol invite message on the wireless device; and
parsing the Session Initiation Protocol invite message on the wireless device.

22. The method of claim **21**, wherein registering the wireless device includes indicating that the wireless device is a direct device.

23. The method of claim **21**, further comprising establishing the device management session between the wireless device and the device management server.

* * * * *